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CIA-RDP86-00513R000928110006-4

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was studied. The intrinsic viscosity of the unreacted
vulcanizate was determined by the bond energies
which were 62.7 kcal/mole for the 54 kcal/mole

Category : USSR/Atomic and Molecular Physics - Physics of High-Molecular Substances

D-9

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3615

Author : Kuz'minskiy, A.S., Cherkova, V.F.

Inst : Scientific Research Institute of Rubber Industry, Moscow

Title : On the Nature of the Optimum Vulcanization of Natural Latex.

Orig Pub : Dokl. AN SSSR, 1956, 107, No 3, 428-431

Abstract : In the vulcanization of unfilled mixtures of natural latex containing accelerators (thiuram or diphenyl guanidine), the maximum amount of mobile sulphur (capable of exchange) corresponds to the optimum strength. When polysulfide sulphur is extracted from the vulcanizates with the aid of Na_2SO_3 , the strength is decreased, particularly at the optimum. No reversion is observed when vulcanizing with thiuram without sulphur, i.e., the presence of polysulfide bonds is an essential condition for the reversion. Swelling of the vulcanizates in vaseline oil (to the limit) and an increase in the test temperature (in the range from 25 to 140°) cause a sharp reduction in the tearing strength, this leading to the conclusion that the role of the transverse bonds lies principally in their favorable effect on the orientation and crystallization of the molecular chains.

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KUOMINSKIY, A. S., and LESHNEV, N. N.

"Surface activity and particle size of carbon blacks," a paper presented at the 9th Congress on the Chemistry and Physics of High Polymers, 28 Jan-2 Feb 57, Moscow, Rubber Research Inst.

B-3,084,395

Kuz'minskiy, A.S.

Call Nr: AF 1154947

AUTHORS: Kuz'minskiy, A.S., Lezhnev, N.N., Zuyev, Yu.S.

TITLE: Oxidation of Natural and Vulcanized Rubbers (Oksileniye kauchukov i rezin)

PUB.DATA: Gosudarstvennoye nauchno-tekhnicheskoye izdatel'stvo khimicheskoy literatury, Moscow, 1957, 319 pp., 5,000 copies

ORIG.AGENCY: None given

EDITORS: Babushkina, S.I.; Tech. Ed.: Lur'ye, M.S.

PURPOSE: The monograph is intended for scientific and engineering personnel of the rubber industry, and for specialists in allied fields of chemical technology.

Card 1/10

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Oxidation of Natural and Vulcanized Rubbers (Cont.)

COVERAGE: The book discusses aging of natural and vulcanized rubbers caused by oxygen, ozone, high temperature, light, mechanical stress and catalysts. Methods of studying aging and prevention of aging are reviewed. Personalities mentioned include: Angert, L.G., Belitskaya, R.M., Degteva, T.G., Lyubchanskaya, L.I., Mayzel's, M.G., Peschanskaya, R.Ya., Popova, Ye.B., Postovskaya, A.F., Khitrova, N.G., Shemastina, Ye.V., Shokhin, N.A., Shanin, L.L., Kargin, V.A., Medvedev, S.S., Dogadkin, B.A., Dolgoploskiy, B.A., Rebinder, P.A., Slonimskiy, G.L., Bartenev, G.M., Abkin, A.D., Reytlinger, S.A. There are 42 references, 19 USSR, 20 English, 2 German, 1 French. There is a bibliography at the end of each chapter.

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Call Nr: AF 1154947

Oxidation of Natural and Vulcanized Rubbers (Cont.)

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Call Nr: AF 1154947

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Call Nr: AF 1154947

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Call Nr: AF 1154947

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Call Nr: AF 1154957

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AVAILABLE: Library of Congress

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- PRIKHOTKO, N. F.
24(7) 13 PHASE I BOOK EXPLOITATION 804/1365
L'vov. Universitet
- Materialy X Vsesoyuznogo sveshchaniya po spektroskopii. t. 1: Molekulyarnaya spektroskopiya (Papers of the 10th All-Union Conference on Spectroscopy. Vol. 1: Molecular Spectroscopy) [L'vov] Izd-vo L'vovskogo univ-ta, 1957. 499 p. 4,000 copies printed. (Series: Its: Fizichnyy zhurnal, vyp. 1/8/)
- Additional Sponsoring Agency: Akademiya nauk SSSR. Komissiya po spektroskopii. Ed.: Jazev, S.L.; Tech. Ed.: Saranyuk, T.V.; Editorial Board: Lavdarsky, G.S., Academician (Resp. Ed., Deceased), Neporent, B.S., Doctor of Physical and Mathematical Sciences, Fabrikant, I.L., Doctor of Physical and Mathematical Sciences, Kornitskiy, V.G., Doctor of Physical and Mathematical Sciences, Candidate of Physical and Mathematical Sciences, Klimovskiy, I.K., Candidate of Physical and Mathematical Sciences, Miliyanchuk, V.S., A. Ye., Candidate of Physical and Mathematical Sciences.
- Card 1/30
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- Postovskaya, A.F., I.A. Salimov, A.S. Rus'minskiy, and V.M. Tatevakiy. Variation in Structure of Sodium Butadiene Rubber in the Process of Light Oxidation 423
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POSTOVSKAYA, A.F.; SALIMOV, M.A.; KUZ'MINSKIY, A.S.; TATEVSKIY, V.M.

Structural changes of sodium-butadiene rubber in the process of
light oxidation. Fiz. sbor. no.3:423-427 '57. (MIRA 11:8)

1. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti i
Khimicheskiy fakul'tet Moskovskogo ordena Lenina i ordena Trudovogo
Krasnogo Znameni gosudarstvennogo universiteta im. N.V. Lomonosova;
(Rubber--Spectra) (Oxidation)

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CIA-RDP86-00513R000928110006-4"

LYUBCHANSKAYA, L.I.; SHLYAKHMAN, A.A.; KUZ'MINSKIY, A.S.

Apparatus for testing axial compression stress relaxation of elastic materials. Kauch. i rez. 16 no.2:31-33 P '57. (MIRA 12:3)

1. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti.
(Rubber, Testing)

KUZ'MINSKIY, A.G.; BASS, S.I.

Ninth conference on general problems relative to the chemical
and physical properties of high molecular weight compounds.
Kauch. i rez. 16 no. 4:37-40 Ap '57. (MIRA 10:7)
(Macromolecular compounds)

KUZ'MINSKIY, A.S.; NIKITINA, T.S.; TSETLIN, B.L.

Effect of ionizing radiation on rubbers and vulcanizates. Kauch.
i rez. 16 no.6:12-18 Je '57. (MIRA 10:10)

1. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti.
(Rubber) (Radiation) (Vulcanization)

KUZ'MINSKIY, A.S.

Scientific research in the physics and chemistry of crude and
vulcanized rubber during the last forty years. Kauch. i rez.

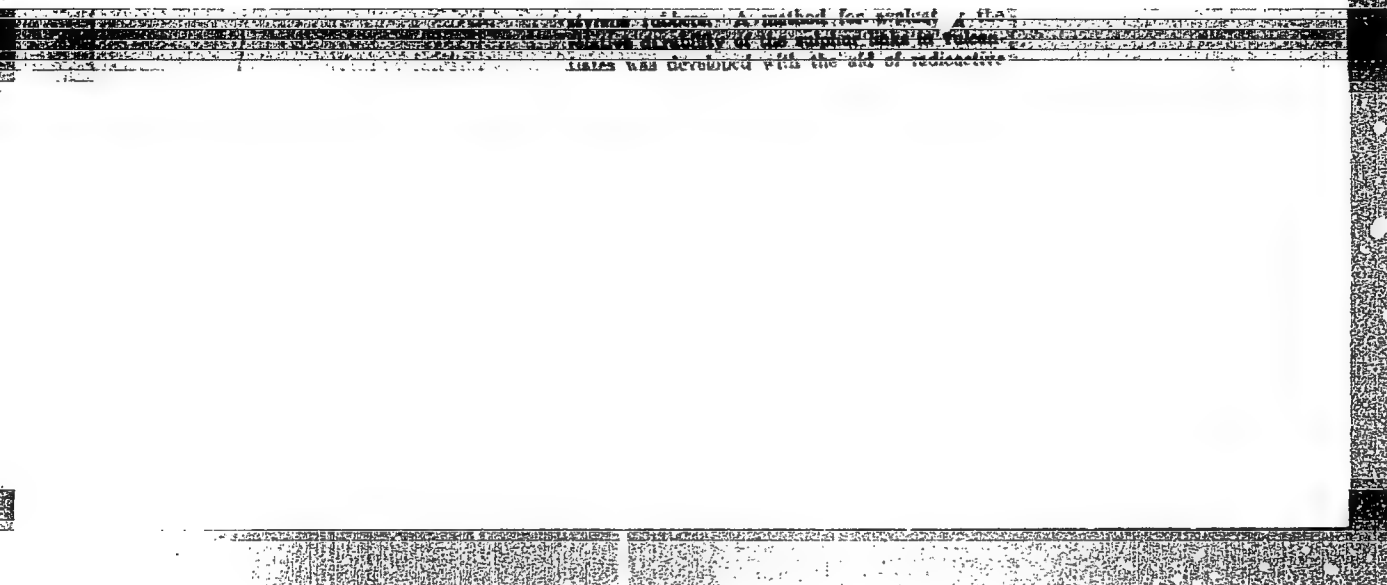
16 no.10:32-44 0 '57.

(MIRA 11:1)

(Rubber research)

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The product contained evolved H₂ and CO₂ was evolved.
The product contained evolved H₂ and CO₂ was evolved.
and much H₂ was evolved on decomposition. The polymer
butylene decoupled at 60°, but very rupture with the zone.

20-114-3-37/60

AUTHORS: Postovskaya, A. F., Salimov, M. A., Kuz'minskiy, A.S.

TITLE: On the Changes in the Degree of Sulphidity of Sulphur Structures in Vulcanized Products When Exposed to Light (Ob izmenenii stepeni sul'fidnosti sernykh struktur v vulkanizatakh pri svetovom vozdeystvii)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol. 114, Nr 3, pp. 586-589 (USSR)

ABSTRACT: The authors of the paper under review have demonstrated in an earlier paper that sulphur vulcanized products of sodium butadiene rubber (polysulphide and thiuram products) differing from each other by the structure of their transverse bonds are of different stability to light. The polysulphide vulcanized product is more stable. If it is exposed to ultraviolet light this exposure is accompanied by the decomposition of the sulphur compounds and by the formation of free sulphur which, unlike elemental sulphur, does not take part in the processes of photovulcanization, i.e. remains "inactive". It was not determined of what kind the structure of this inactive sulphur is, neither was the question clarified just how the degree of sulphidity of sulphur in these vulcanized products

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20-114-3-37/60

On the Changes in the Degree of Sulphidity of Sulphur Structures in Vulcanized Products When Exposed to Light

changes when exposed to light. Therefore it is not possible to give an answer to the very important question of **why one** vulcanized product should be more resistant to light than another. The paper under review is devoted to the investigation of this question. Research as to the type of sulphur compounds is hindered by different obstacles. For instance, it is possible that polysulphide structures had been overlooked in the ~~thiuram~~ vulcanized product. Because of several reasons, ultraviolet spectroscopy was applied to the investigation of the change in the degree of sulphidity of sulphur structures of both kinds of vulcanized products when exposed to ultraviolet light. The results of this investigation are compiled in tables Nr 1 - 3 in the paper under review. Figure Nr 1 shows that, if compared to pure rubber, the absorption in polysulphide vulcanized rubber is intensified in the interval of 2200 - 5400 Å. This can be explained by the existence of sulphur structures of different degrees of sulphidity. If polysulphide vulcanized rubber is exposed to light, the intensity of the absorption is reduced. This is explained by the decomposition of polysulphide bonds,

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20-114-3-37/60

On the Changes in the Degree of Sulphidity of Sulphur Structures in Vulcanized Products When Exposed to Light

with the sulphide of higher order having a higher stability to light. Figure Nr 2 shows for thiuram vulcanized rubber a maximum of absorption in the interval between 2500 and 2600 Å corresponding to the presence of di- and trisulphides. Higher sulphides are present in smaller quantities. Exposure to light of thiuram vulcanized rubber is accompanied by the decomposition mainly of the hexa-sulphides and of the still higher sulphides. Comparing figure Nr 1 and Nr 2, as contained in the paper under review, it is seen that thiuram vulcanized rubber, in spite of the fact that its contents of bound sulphur are only 1/4 of the contents in polysulphide vulcanized rubber, shows more intense absorption in the ultraviolet and in the visible range. This is probably caused by the different distribution of the bound sulphur upon the different sulphur structure. Analysis of the material obtained from these experiments leads to the conclusion that the higher stability to light of the polysulphide vulcanized rubber as compared to the vulcanized rubber must be explained by the difference in the absorption in the ultraviolet range

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20-114-3-37/60

On the Change in the Degree of Sulphidity of Sulphur Structures in Vulcanized Products When Exposed to Light

and by the relevant sulphur structures. There are 3 figures and 12 references, 4 of which are Soviet.

ASSOCIATION: Scientific Research Institute of Rubber Industry
(Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti)
Moscow State University imeni M. V. Lomonosov
(Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova)

PRESENTED: November 22, 1956, by P. A. Rebinder, Member of the Academy

SUBMITTED: November 22, 1956

AVAILABLE: Library of Congress

Card 4/4

KUZ' MINSKIY, A.S.

AUTHOR
TITLE

DEGETVA, T.G. and KUZ'MINSKIY, A.S. 20-2-40/62
Influence of the Chemical Nature of Solvents on the
Oxidation of Rubber in Solutions.
(Vliyaniye khimicheskoy prirody rastvoriteley na
okisleniye kauchuka v rastvorakh.- Russian)
Doklady Akademii Nauk SSSR 1957, Vol 115, Nr 2,
pp 339-342 (U.S.S.R.)

PERIODICAL

ABSTRACT

Many research workers use rubber solutions in the
modelling of oxidation processes which take place in
rubber in a solid state. Chief attention is in this
connection paid to the transformation of the polymers
themselves. As far as the solvent is concerned (foot-
note: under that have to be understood low-molecular
rubber - dissolving hydrocarbons), its parts in the
oxidation of rubber solutions is not at all discussed.
The participation of the solvent in the mentioned
process, however, becomes obvious from the generally
accepted radical chain mechanism of the oxidation of
hydrocarbons. The object of the present investigation
was a study of the influence of the chemical nature of
the solvent, as may be seen from the title. Purified
sodium-butadiene rubber dissolved in aromatic, naphthene-
and naphthenearomatic hydrocarbons was investigated.

CARD 1/4

20-2-40/62

Influence of the Chemical Nature of Solvents on the
Oxidation of Rubber in Solutions.

These latter had a varied oxidation reactivity. A special apparatus was constructed for the oxidation of solutions and solvents, in order to abolish diffusion inhibitions of oxygen. The kinetic oxidation curves recorded in ill.1 explain the oxidation speed of 1% rubber solutions. It increases in the series: toluol < xylol < decalin < ethylbenzene < isopropylbenzene < tetralin. These substances themselves form a special series: toluol < xylol < ethylbenzene < isopropylbenzene. In benzene 1% rubber solutions are slower oxidized than in toluol. The differences can have been caused only by different action of the solvent on the development of the radical chain process. The problem rises, on which elementary acts of the reaction the solvent acts most essentially, and in which manner its chemical nature becomes effective in this connection. It follows from published data and some considerations that the seizing of the radicals R' and ROO' by the benzene molecules must lead to the separation of the primary oxidation chain, whereas the seizing of the radicals RO' and OH must lead to a separation. On the transition from benzene to toluol the polymeric radical ROO' develops a new possibility of stabilization, namely by separation of a hydrogen molecule

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20-2-40/62

Influence of the Chemical Nature of Solvents on the
Oxidation of Rubber in Solutions.

from the methyl groups of toluol under formation of a
little active benzyl radical. This latter comparatively
readily enters interaction with oxygen and forms a
radical



This radical, in case that it is not seized by a toluol
molecule, can stabilize on separation of hydrogen under
formation of toluol hydroperoxide. The reaction of
transmission of the oxidation chain from the rubber mole-
cule to the solvent's molecules leads to an increase
of this chain in length. On conversion from toluol to
xylol, ethylbenzene and isopropylbenzene the movability
of hydrogen in the side chain increases. Thereby the
oxydation speed in the mentioned series increase still
further. The influence of the various chemical natura
of the solvent's molecules manifests itself also in
tetralin and decalin. Intermediate products comparati-

CARD 3/4

20-2-40/62

Influence of the Chemical Nature of Solvents on the
Oxidation of Rubber in Solutions.

very rapid accumulate in tetralin. They decompose and promote the autocatalytic oxidation of rubber solutions. At 90°C the oxidation in decalin occurs very slowly, since the peroxide radicals are not able of separating an H-atom from the solvent's molecule. At 100°C the speed abruptly increases. Thus the solvents can slow down or accelerate the oxidation or they can stand apart from the process by acting as diluents. After the accelerating action they form a series: tetralin < isopropylbenzene < ethylbenzene; after the retarding action: benzene < toluol < xylol.
(3 Illustrations, 5 Slavic references)

ASSOCIATION:

Scientific research institute of rubber industry.
(Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti)

PRESENTED BY:

P.A. REBINDER, Member of the Academy, Feb. 21, 1957

SUBMITTED:

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AVAILABLE:

Library of Congress.

CARD 4/4

Kuz'minskiy, A.S.

PAVLOV, Sergey Aleksandrovich, prof.; AVILOV, Aleksey Alekseyevich, kand.tekhn.nauk; BARAMBOYM, Nikolay Konstantinovich, prof.; MONASTYRSKAYA, Mariya Solomonovna, dotsent; KHROMOVA, Nina Sergeyevna, dotsent; KUZ'MINSKIY, A.S., prof., retsenzent; KIPNIS, B.Ya., inzh., retsenzent; MINAIEVA, T.M., red.; GUSEVA, A.I., red.; MEDVEDEV, L.Ya., tekhn.red.

[Technology of artificial leather] Tekhnologiya iskusstvennoi koshi. Pod red. S.A.Pavlova. Moskva, Gos.nauchno-tekhn.isd-vo lit-ry po legkoi promyshl., 1958. 654 p. (MIRA 12:4)
(Leather, Artificial)

USSR/General Problems. Methodology. History. Scientific A
Institutions and Conferences. Teaching. Problems
of Bibliography and Scientific Documentation

Abs Jour : Ref Zhur-Khimiya, No 4, 1958, 10233

Author : A. S. Kuz'minskiy

Inst : Not given

Title : Scientific Works on the Physics and Chemistry
of Caoutchouc and Rubber in 40 Years

Orig Pub : Kauchuk i rezina, 1957, No 10, 32-44, Bibliography
44 titles

Abstract : No abstract

Card 1/1

USSR / Chemistry of High Molecules, Comp. 19/2000 Kuz'minskiy A.S. CIA-RDP86-00513R000928110006-4

Abs Jour : Ref. Zhur. - Khimiya, No.2, 1958, 6761.

Author : Salimov, N.A., Postovskaya, A.F., Kuz'minskiy, A.S.,
Tatevskiy, V.M.

Inst : Moscow University

Title : Investigation of Structural Changes of Sodium Butadiene
Caoutchouc in the Thermal Oxidation Process using Infra-
Red Spectroscopy Method.

Orig Pub : Vesti. Mosk. un-ta. Ser. matem., mekhan., astron., fiz.,
khimiya, 1957, No.1, 164-169.
12

Abstract : By studying the IK (infra-red) spectra of thermally ox-
idized sodium butadiene caoutchouc at 140° (60 min. oxidation),
it has been established that during the oxidation process
the following oxygen-containing groups were formed:

Card : 1/3

USSR / Chemistry of High Molecular Compounds.

L.

Abs Jour : Ref. Zhur. - Khimiya, No.2, 1958, 6761.

Abstract : analogous decrease of intensities was also observed for absorption bands of double bonds $C = C$ at 1640 cm^{-1} and for valence oscillation $C-H$ of double bonds at 2979, 3019 and 3080 cm^{-1} ; ~~a decrease of absorption bands~~ of methylene groups $-CH$ at 720, 2856 and 2929 cm^{-1} showed that O atoms in addition to double bonding attach themselves also to C atoms located in α position to the double bonds. An increase in intensity of the absorption band at 3400 cm^{-1} is linked to the formation of hydroxyl rather than hydroperoxide groups as it was confirmed by the results of the iodometric method.

Card : 3/3

KUZ'MINSKIY, A. S., OKSENT'YEVICH, L. A., KORPOV, V. L., and NIKITINA, T. S.

"Radiation Vulcanization of Rubber"

Truly Transactions of the First Conference on Radioaction Chemistry, Moscow,
Izd-vo AN SSSR, 1958. 330pp.
Conference -25-30 March 1957, Moscow

AU/ MINDALL, A. D., and KIDAKENKO, A. P.

"The properties of rubber and resin solutions."

report presented at the Fourth All-Union Conference on Colloidal Chemistry,
Tbilisi, Georgian SSR, 12-16 May 1958 (Koll zhur, 20,5, p.677-9, '58, Traubman, A.B)

KUZMINSKIY, A. S. and ANGERT, L. G.

(Scientific Research Institute of the Rubber Industry, Moscow, USSR)

"On the Oxidation Mechanism of Rubbers in the Presence of Inhibitors,"
paper submitted at Soviet High-Polymers, Intl. Conference, Nottingham,
21-24 July 1958.

E-3,109,661

KUZMINSKIY, A. S., NIKITINA, T. S., ZHURAVSKAYA, E. V., ORSENT' YEVICH, L. A.,
SUNITSA, L. L., and VITUSEKIN, N. I.

"The Effect of Ionizing Radiations on Crude and Vulcanized Rubbers."

paper to be presented at 2nd UN Intl. Conf. on the peaceful uses of Atomic
Energy, Geneva, 1 - 13 Sep 58.

SOV/58-59-8-17760

Translated from: Referativnyy Zhurnal Fizika, 1959, Nr 8, p 112 (USSR)

AUTHORS: Nikitina, T.S., Kuz'minskiy, A.S., Karpov, V.L.

TITLE: The Radiation Vulcanization of Caoutchoucs

PERIODICAL: V sb.: Deystviye ioniziruyushchikh izlucheniye neorgan. i organ. sistemy. Moscow, AN SSSR, 1958, pp 333-343

ABSTRACT: The article has not been reviewed.

Card 1/1

SOV/138-58-6-2/25

AUTHORS: Kuz'minskiy, A.S. and Lyubehanskaya, L.I.

TITLE: Methods for Evaluating the Guarantee Period for which Rubber may be kept (O metodakh otsenki garantiynykh srokov khraneniya rezin)

PERIODICAL: Kauchuk i Rezina, 1958, Nr 6, pp 3 - 8 (USSR)

ABSTRACT: Plants and apparatus which are fitted with rubber parts are more exposed to the aggressive action of the medium than materials such as metals, enamel, glass, etc. Ageing of the rubber occurs, which is due to atmospheric agents (oxygen, ozone, etc.). This ageing is characterised by irreversible changes in the properties of the material (strength, elasticity, residual deformation, hardness, etc.). Reversible changes of the mechanical properties of rubbers can be observed during investigations at high temperatures, but these should not be confused with irreversible changes of the same properties during ageing. Experiments were carried out on non-tensioned rubbers. Various physical-mechanical properties of rubber e.g., the relative elongation at break and the modulus of elasticity change during ageing of natural rubbers. A linear

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SOV/138-58-6-2/25

Methods for Evaluating the Guarantee Period for which Rubber may be kept

relation is observed, sometimes, between the relative elongation and the quantity of absorbed oxygen (data on the oxidation of NK and on SKN-26 were computed by L.G. Angert). The work of N.N. Lezhnev (Reference 15) is mentioned, and the following conclusions are made: (a) in wide temperature limits (from room temperature to 150°C) the temperature coefficients for the rate of change of various properties of rubbers vary between 1.8 - 3.5. The ageing of rubber 2959 (based on natural rubber), in air and also in nitrogen, at 90°C, is shown in a graph (Fig 1); (b) rubbers based on natural rubber have higher temperature coefficients than rubbers based on synthetic rubber. Extrapolation calculations of the thermal dependence of the rate of chemical processes are given. The accuracy of these calculations, which are based on the Arrhenius equation, is discussed. Graphs for the kinetic changes of relative elongation during the ageing of rubber 2959 at 90°, 70° and 50°C are given in Fig 2. Table 1 gives data on the ageing of rubber (based on NK) with various vulcanisation groups. Fig 3 shows thermal

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SOV/138.-58-6-2/25

Methods for Evaluating the Guarantee Period for which Rubber may be kept

dependence of the rate of oxidation of rubbers. The ageing of rubber, subjected to load, was investigated. Mechanical stresses cause a breaking-up of the molecular chains, and especially of the weaker polysulphide bonds, and a regrouping of the sulphur bonds occurs, Figs 4 & 5 give data on the thermal effect on rubbers of various structure in air and in vacuum. The chemical relaxation was tested on the apparatus constructed by L.I. Lyubchan-skaya, A.A. Shlyakhman and A.S. Kuz'minskiy (Ref. 14). When rubber is aged while subjected to stress, inter-molecular bonds are destroyed, but at the same time, new bonds are created and deformations become permanent. Fig 6 shows how deformation or permanent set increases at the same time as the stress in the rubber decreases. Stress is plotted as a fraction of the original stress in the rubber, and elongation as a percentage of the original dimension of the loaded specimen. The test is conducted over a duration of 160 hours at a temperature of 90°C. The physical and mechanical coefficients for ageing which

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SOV/138-58-6-2/25

Methods for Evaluating the Guarantee Period for which Rubber may be kept

are satisfactory for predictions with unstressed rubbers, are inapplicable to rubber aged under stress. In Fig 7, curves 1 and 3 show the strength (kg/cm^2), and proportional elongation (L %), for unstressed rubbers, with respect to time of ageing while the rubber was at a temperature of 70°C . Curves 2 and 4 show the same functions for the rubber while stressed by an extension to 50% of its original dimension. Curve 5 shows residual deformation or permanent set. The strength and elasticity, in both stressed and unstressed conditions, change with respect to ageing at almost the same rate, i.e. the curves do not reflect the specific ageing of the stressed rubber. While the proportional elasticity and the strength has fallen to 20 - 30% of the initial value in both cases, permanent set has increased to 80 - 90% in the stressed rubber. Specific ageing of stressed rubber depends on "auto-relaxation" of the molecular structure. Acceptable indices of ageing in stressed rubbers are, therefore, permanent set and relaxation of stress (chemical relaxation). The

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SOV/138-58-6-2/25

Methods for Evaluating the Guarantee Period for which Rubber may be kept

latter is the index which properly determines the mechanical behaviour of rubber when aged while under stress.

Curves 1, 2 and 3 in Fig 9 show the stress relaxation on ageing for different degrees of initial compression, while curve 4 shows that the percentage permanent set is about the same for all three initial conditions.

Summarizing: the dependence of the rate of ageing with temperature is a primary factor when defining the stability of rubber. For rubber under unstressed conditions, proportional elongation, breaking strength and modulus are suitable indices of ageing. These indices are not applicable for rubber aged under stress. The loss in working properties of rubber when aged under stress is a function of two causes: chemical relaxation of stress, and increase in permanent set. The rates of change of these two functions are suitable indices for predicting the effect of ageing of rubber while under stress.

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SOV/138-58-6-2/25

Methods for Evaluating the Guarantee Period for which Rubber may be kept

Mechanical loads, apart from activating oxydation processes, lead both to disruption and to formation of molecular bonds. Permanent set is the external manifestation of these processes.

There are 9 figures, 1 table and 15 references (6 English, 1 French and 8 Soviet)

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti (Research Institute of the Rubber Industry)

1. Rubber--Life expectancy
2. Rubber--Test results
3. Rubber--Mechanical properties

Card 6/6

SOV/138-58-7-3/19
AUTHORS: Postovskaya, A.F., Kuz'minskiy, A.S. and Mikhaylova, G.N.
TITLE: Means of Determining the Permeability of Rubber and
Rubber Compositions to Acids (Metodika opredeleniya
kislotopronitsayemosti kauchukov i rezin)
PERIODICAL: Kauchuk i rezina, 1958, Nr 7, pp 11 - 13 (USSR)
ABSTRACT: The acid permeability of rubber is important in connection with components such as sealing rings, gaskets, diaphragms, etc.
A method is described which gives consistent results and depends upon the measurement of the concentration of acid which has diffused through a diaphragm. The acid concentration is determined from its conductivity, using a Wheatstone bridge and current at frequencies in the range 1 000 to 4 000 cps, in order to prevent errors through polarisation at the electrodes.
The measuring vessel is shown in Figure 1. The right-hand portion contains two platinised-tin electrodes, connected to the bridge circuit shown in Figure 2. This portion is filled with distilled water and is divided from the left-hand part of the vessel by the membrane under test. The left-hand part is filled with an acid solution - in an example given - with 27% nitric acid. Constants for the vessel were determined by calibration with a calcium chloride solution of known specific resistance.

Card1/3

SOV/138-58-7-3/19

Means of Determining the Permeability of Rubber and Rubber
Compositions to Acids

Calibration curves could then be constructed for specific conductivity against acid concentration, as in Figure 3, which plots both experimental findings and standard reference data, showing good agreement. The fact that the curve passes through a maximum is due to changes in the degree of dissociation of the acid at higher concentrations.

Determination of diffusion through three different membranes of SKS rubber is shown in Figure 4. After a short time, the rate of diffusion falls off, apparently because reaction products between membrane and acid block the surface. After some further time, diffusion again increases through the formation of cracks and change in the structure of the vulcanised membrane. There are 4 figures and 14 references, 12 of which are English and 2 Soviet.

Card2/3

SOV/138-58-7-3/19

Means of Determining the Permeability of Rubber and Rubber Compositions
to Acids

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promy-shlennosti
(Scientific-Research Institute of the Rubber Industry)

Card3/3 1. Rubber--Physical properties 2. Rubber--Test results
 3. Nitric acid--Properties

AUTHOR: A.S. Kus'minskiy **SOV/138-58-12-9/17**
TITLE: Second International Conference on Peaceful Uses of Atomic Energy (Vtoraya mezhdunarodnaya konferentsiya po primeneniyu atomnoy energii v mirnykh tselyakh)
PERIODICAL: Kauchuk i Resina, 1958, Nr 12, pp 28-29 (USSR)
ABSTRACT: The article reviews papers presented at the U.N.O. Conference at Geneva in September 1958 on radiation chemistry of polymers. Among those mentioned are: The mechanism of radiation vulcanization of polyethylene and other polymers by Academician S.G. Medvedev. The effect of ionizing radiations on rubber and rubber compositions. Work by R. Meshrebyan (USA) on radiation vulcanization on natural rubber. Work by R. Roberts (UK) on radiation polymerization on fluorinated monomers. K. Shinohara (Japan) on co-polymerization of polyethylene fibres. O. Tesler and N. Razerford (USA) on effect of radiation on natural and synthetic fibres.

Card 1/2

R. Fritch (West Germany) on the effect of gamma radiation on natural and synthetic wool fibres. Academician A.V. Topchigov on the production and use of radioactive isotopes in the USSR.

Card 2/2

KUZ'MINSKIY, A.S.; LYUBCHANSKAYA, L.I.

Methods of determining guaranteed storage limits for rubber. Kauch.
i rez. 17 no.6:3-8 Je '58. (MIRA 11:7)

1.Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti.
(Rubber--Storage)

POSTOVSKAYA, A.F.; KUZ'MINSKIY, A.S.; MIKHAYLOVA, G.N.

Method for determining the acid permeability of crude and
vulcanized rubbers. Kauch. i rez. 17 no. 7:11-13 Jy '59.(MIRA 11:7)

1. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti.
(Rubber--Testing)

KUZ'MINSKIY, A.S.

Second International Conference on the Peaceful Uses of Atomic
Energy. Kauch. i rez. 17 no.12:28-29 D '58. (MIRA 12:1)
(Radiochemistry) (Atomic energy research--International cooperation)

AUTHORS: Kuz'minskiy, A. S., Borkova, L. V.

SOV/76-32-9-16/46

TITLE: The Vulcanization and Mechanical Properties of Ebonites
(Vulkanizatsiya i mekhanicheskiye svoystva ebonitov)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol 32, Nr 9,
pp 2051 - 2060 (USSR)

ABSTRACT: The authors investigated ebonite, which was prepared from divinyl styrene caoutchouc SKS 30. The vulcanization was carried out at different temperatures (150°, 170°, and 190° C) using different amounts of sulfur. The mechanical properties of the ebonite were measured in the air and at 130° C using a Polyani type dynamometer. All the experimental results are reproduced in the form of graphs. In the vulcanization process two opposed tendencies, the formation and destruction of sulfur cross connections, come into play. In the early stages of vulcanization polysulfide bonds form. Under optimal vulcanization conditions only the mono- and disulfides remain. By the formation of a thick, three-dimensional net the strength of the reciprocal intermolecular effect grows until the material goes over into the glassy state.

Card 1/2

The Vulcanization and Mechanical Properties of Ebonites SOV/76-32-2-16/46

At 150° to 170°C the ebonite begins to flow, since the sulfur bonds break. This flow is a specific property of sulfur ebonite. At 150-170°C thermoebonite, rubber, and caoutchoucine show intensive three-dimensional connections. Sulfur ebonites do not show this behavior as a result of the inhibiting effect of the sulfur, which is produced by a rupture of the sulfur bond. There are 12 figures and 19 references, 14 of which are Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti, Moskva (Moscow Scientific Research Institute of the Rubber Industry)

SUBMITTED: August 16, 1956

Card 2/2

AUTHORS: Reytlinger, S. A., Kuz'minskiy, A. S., SSV/26-126-2-33/63
Fel'dshteyn, L. S.

TITLE: On the Nature of the Bindings and the Gas Penetrability of Space-Structured Polybutadiene (O prirode svyazey i gazopronitsayemosti prostranstvenno-strukturirovannogo polibutadiyena)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 2, pp. 343 - 345 (USSR)

ABSTRACT: First the authors discuss various previous papers and give a survey of the results obtained. The interest of the authors was directed towards the clarification of the separate influence of the bridge-like covalent bindings and of the intermolecular bindings upon gas penetrability. Space-structured polybutadienes differing as to the chemical nature of the transverse bonds were investigated. The space lattice in polybutadiene was made visible by the following means: Heating in a press at 220°, irradiation by radiation from Co⁶⁰, heating with sulfur and diphenyl guanidine, heating with sulfur and thiouram. The density of the lattices was varied by several methods. The results of the investigations

Card 1/3

On the Nature of the Bindings and the Gas
Penetrability of Space-Structured Polybutadiene

SOV/20-120-2-33/63

are illustrated in a diagram. The dissolved sulfur exercises almost no influence upon the penetrability of rubber to nitrogen. Even if sulfur is bound intramolecularly, only a small modification of the penetrability is found. The bridge-like sulfur bindings between the chain-like molecules of the polymer exercise a greater influence upon the reduction of the penetrability than the same amount of sulfur-containing groups which are bound intramolecularly. A diagram illustrates as an example the typical dependence of the equilibrium modulus and of the nitrogen penetrability upon the duration of heating (220°). The reduction of gas penetrability which is found at a space structuring is accompanied by an inversely proportional increase of the equilibrium modulus. There are 3 figures and 12 references, 6 of which are Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti
(Scientific Research Institute of Rubber Industry)

PRESENTED: January 13, 1958, by P.A. Rebinder, Member, Academy of Sciences,
USSR

Card 2/3

On the Nature of the Bindings and the Gas
Penetrability of Space-Structured Polybutadiene

1957 12-120-2-30/63

SUBMITTED: January 15, 1958

1. Butadienes—Theory 2. Gases—Penetration 3. Heat
—Applications 4. Molecular association—Theory

Card 3/3

SOV/3439

PHASE I BOOK EXPLOITATION

5(3), 21(8)

Nikitina, T.S., Ye. V. Zhuravskaya, and A.S. Kuz'minskiy

Deystviye ioniziruyushchikh izlucheniye na polimery (Effect of Ionizing Radiations on Polymers) Moscow, Goskhimizdat, 1959. 101 p. (Series: Moscow. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti) Errata slip inserted. 4,300 copies printed.

Sponsoring Agency: USSR . . . Sovet Ministrov. Gosudarstvennyy komitet po khimii.

PURPOSE: This booklet is intended for scientific workers, engineers and technicians exploring the possibility of using ionizing radiation for changing properties of long-chain polymers.

COVERAGE: An attempt is made to sum up the information from Soviet and non-Soviet sources on the behavior of high polymers when exposed to high energy radiation. The authors review general principles of ionizing radiation and its effect on high polymers. The mechanism of processes induced by nuclear radiation in polymers is discussed along with changes in chemical, physical, mechanical, and electrical properties of polymers resulting from exposure of the latter to radiation. Formation of ionized molecules, excited molecules and free radicals obtained from the dissociation of ionized or excited molecules is discussed

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80V/3439

Effect of Ionizing Radiations (Cont.)

and results of the irradiation of such polymeric materials as plastics, natural and synthetic rubber and fiber are analyzed. The role of oxygen in the irradiation of polymers, the gas liberation and the dependence of change in molecular weight on the radiation dosage is explained. The study of experimental results reveals that the irradiation of polymer compounds produces substantial changes in all their properties. Basically, the irradiation of polymers results either in crosslinking or scission of their chains. Conditions under which radiation takes place, such as temperature, radiation dose, polymer phase, etc. are not considered. The appendix lists a number of irradiated polymers with changes in their properties induced by radiation. There are 206 references: 30 Soviet and 176 non-Soviet in English, German, French and Swedish.

TABLE OF CONTENTS:

Introduction

1. General Information
 - Interaction of radiation and matter
 - Units of measurement employed in the field of ionizing radiation
 - Sources of radiation

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Effect of Ionizing Radiations (Cont.)

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Effect of Ionizing Radiations (Cont.)

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KUZ' MINSKIY, A.S.

WHAT I DOO KEEVATION

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International Conference on the Peaceful Uses of Atomic Energy. 2d, Geneva, 1958.

Book by sovetskikh uchenykh. [L.] Khimika radionuklyev i radioaktivnykh pereobrazheniy (Reports of Soviet Scientists. v. 4.; Chemistry of Radioelements and Radioactive Transformations) Moscow, Atomizdat, 1959. 323 p. 8,000 copies printed. (Series: Ita; Ity)

Ed. (title page): A. P. Vinogradov, Academician; Ed.: V. I. Labarev; Tech. Ed.: Zh. I. Khmel'.
20. I. Khmel'.

purpose: This collection of articles is intended for scientists and engineers interested in the applications of radioactive materials in science and industry.

CONTENTS: The book contains 26 separate studies concerning various aspects of the chemistry of certain radioactive elements and the processes of radiation effect on matter. These reports discuss present-day methods of reprocessing irradiated nuclear fuel, research in the chemistry of mercury, thorium, uranium, plutonium, and americium, problems related to the sorption and heavy-

ing of redoxactive waves, the radiolysis of aqueous solutions and of organic compounds, the mechanism of polymer chain grafting, and the effect of radiation on natural and synthetic rubbers. V. I. Prusakov edited the section on radiation effects on polymers. The authors of the papers presented values. Most of the reports are accompanied by references. Contributors to individual investigations are mentioned in annotations to the table of contents.

THE NEW YORK PUBLIC LIBRARY
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125 WEST 47TH STREET, NEW YORK, N. Y. 10036

Preventative, A. E., Lisa Tang King, and G. S. McIndoe. Mechanism of Polymer Chain Grafting under the Effect of γ -Radiation (Report No. 2294)

Zimakov, P. V., A. V. Pokin, Yu. V. Volnova,
K. A. Kozlovskiy and A. M. Polov
V. V. Kulichenko, E. I.
Proceedings for the 1911-12

Station of Fragmentation Initiators in Initiation Cessatory Processes
(Report No. 2209)
207

Polak, I. S., A. V. Syzhnev, and I. Ya. Chernov. Metabolism of the Alkaloids (Report No. 254)

**Bismuthy, A. S., T. S. Eklund, Dr. V. Zurevsky, L. A. Grant,
Perch, L. L. Smith, and H. I. Vothwin.** Effect of Ionizing Radiation

The following are mentioned for their part in certain phases of the investigation: L. Lyubchanskaya, E. E. Leshnev, P. A. Gailo

Wolff, L. M. *Armenyets*, vol. 20, no. 2, 1957.

Department of Pure Substances (Report No. 2023)
Investigation of the reactivity of small quantities of
200

ment of analysis methods in connection with the present study: M. I. Stetsko, L. P. Alimarin, V. I. Shcheglov, and Professor D. I. Stetsko.

Thurston, E. M., and E. F. Litvinova. Detachment of Gaseous Impurities in Structural and Other Materials (Report No. 2209)

The following are mentioned as having developed experimental techniques and analysis methods relative to this investigation: M. A. Elyashenko, I. I. Kuzin, and Ye. M. Christakova (referred to as "inventors") in connection with the work of the Institute of Chemical Physics of the Academy of Sciences of the USSR.

Leningradskiy Institut Chernoy Metallurgii - Central Scientific Research Institute of Ferrous Metallurgy; S. M. Kostobayev and E. G.

Institute of Geochemistry and Analytical Chemistry); and V. I. Melnyakov (FIAN - Fizicheskiy Institut "A" SSSR - Institute of Physics at USSR)].

Korovis, Pa. L., and L. V. Lipis. Determination by the Spectral Method of Demitracin in Streptomycin and its Compounds (Revert No. 21.77)

as having made a study of eyes from three bases: V. B. Orlov, A. A. Zaslavova, and M. Ya. Zaslavskaya.]

Bkts. I. A., V. I. Medvedevskiy, and V. V. Sarayeva. Radiolysed
and irradiated polymers. Seriya "Soyuznaya Spetsializatsiya"
(Series "Union Specialization") No. 2391

[The following are mentioned: M. S. Kalosova and V. P. Yablonskiy;

10

1990

APPROVED FOR RELEASE: 06/19/2000

CIA-RDP86-00513R000928110006-4"

DEGTEVA, T.G.; KUZ'NINSKIY, A.S.

Effect of the chemical nature of solvents on the oxidation of
rubber in solutions. Vysokom.sped. 1 no.1:73-83 Ja '59.
(MIRA 12:9)

1. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti.
(Rubber) (Oxidation)

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68053
SOV/55-59-3-22/32

AUTHORS:

Salimov, M. A., Zhuravskaya, Ye. V., Kuz'minskiy, A. S.

TITLE:

The Change in the Structure of Sodium Butadiene Rubber by the Action of Ionizing Radiation

PERIODICAL:

Vestnik Moskovskogo universiteta. Seriya matematiki, mekhaniki, astronomii, fiziki, khimii, 1959, Nr 3, pp 177 - 183 (USSR)

ABSTRACT:

The structural change mentioned in the title was investigated by means of infrared absorption spectra. Films (thickness $30 \pm 2 \mu$) made from sodium butadiene rubber with an addition of 2% of the antioxidant phenyl- β -naphthylamine and without oxidizing agent were irradiated with 50.10^6 r/h ($\lambda \sim 1 \text{ \AA}$). Irradiation was carried out partly in air and partly in pure nitrogen. The films were kept in a vacuum. As the spectra were recorded in air, oxidation could not be completely avoided also in the case of samples irradiated in a nitrogen atmosphere. The spectra were recorded by means of a spectrograph of the type IKS-2 within the region of $3800 - 650 \text{ cm}^{-1}$ (Figs 1 - 4). The following results were obtained: 1) Decrease of the intensity of bands corresponding to double bonds

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The Change in the Structure of Sodium Butadiene Rubber by the Action of Ionizing Radiation

(1,2-double bond in the side chain, cis- and trans-1,4-double bond in the principal chain), 2) Increase in absorption within the region of $1400 - 700 \text{ cm}^{-1}$ as a result of increasing branching of the molecules of the polymer. 3) Occurrence of characteristic bands of oxygen-containing groups, viz.: a) Immediately at the beginning of the irradiation of samples without an antioxidizing agent and with a higher irradiation dose for samples with an antioxidizing agent, bands of the valence oscillations of the OH groups occur; b) absorption bands which correspond to carbonyl groups and indicate acids, esters, aldehydes, or ketones. c) Distinct absorption bands at 2700 cm^{-1} , which correspond to aldehydes. The nature of the carbonyl groups was investigated according to N. A. Slovokhotova's method (Ref 2) by conversion of the carboxylic acids and their esters into sodium salts. As shown by figure 5, the carboxylic acids and their esters participate only little in the absorption band 1710 cm^{-1} , where the aldehydes and ketones predominate. Table 1 shows the ratio between acids +

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SOV/55-59-3-22/32

The Change in the Structure of Sodium Butadiene Rubber by the Action of Ionizing Radiation

esters and aldehydes + ketones in dependence on the irradiation dose. The intensity of the bands of oxygen compounds decreases if the sample contains the antioxidizing agent, or if irradiation takes place in nitrogen. Figure 6 shows the decrease in double bonds in irradiated rubber without an antioxidizing agent. The most rapid decrease is found with 1,2-double bonds and trans-1,4-double bonds. The authors thank Professor V. M. Tatevskiy for his advice. There are 6 figures, 1 table, and 16 references, 5 of which are Soviet.

ASSOCIATION: Kafedra fizicheskoy khimii (Chair of Physical Chemistry)
NIIRP (Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti - Scientific Research Institute of the Rubber Industry)

SUBMITTED: January 16, 1959

Card 3/3

SOV/138-59-4-14/26

AUTHORS: Kuz'minskiy, A.S. and Bass, S.I.

TITLE: The VIIIth Mendeleev Congress (VIII Mendeleevskiy
s"yezd)

PERIODICAL: Kauchuk i Rezina, 1959, Nr 4, pp 47-48 (USSR)

ABSTRACT: This Congress on Pure and Applied Chemistry was held from 16th to 23rd March, 1959 in Moscow, and was attended by 1 500 representatives of Soviet Research Institutes, chemical factories and many foreign associations. Academician A.N. Nesmeyanov opened the meeting and emphasised the importance of the Mendeleev Congresses. V.S. Fedorov, representative of the Gosudarstvennyy Komitet Soveta Ministrov SSSR po khimii (State Committee of the Council of Ministers of the USSR for Chemistry) drew attention to Soviet achievements in chemistry. The following papers were read during the Congress: V.A. Kargin on the "Basic Problems in the Chemistry of Polymers"; A.N. Nesmeyanov on "The Periodic Law of D.I. Mendeleev and Organic Chemistry"; N.N. Semenov

Card 1/2

SOV/138-5-4-14/26

The VIIIth Mendeleev Congress

on "Basic Problems of Chemical Kinetics"; A.P. Aleksandrov on "Chemical Aspects of Utilizing Atomic Energy"; Ya. K. Syrkin, Corresponding Member of the Academy of Sciences of the USSR, on "The Basic Problems of the Theory of Chemical Bonds" etc. Special attention was drawn to the chemistry of high-molecular compounds and to methods for preparing starting materials for the synthesis of polymers based on petroleum crudes, further modification of the properties of polymers (block- and graft polymers, radiation vulcanisation etc.). V.A. Kargin discussed three main aspects of polymer chemistry: preparation of polymers which can be used within wide temperature ranges; preparation of new and easily accessible polymer materials and processing of polymers. Further details of the lectures are to be published at a later date.

Card 2/2

SOV/63-4-1-10/1-

15(9)

AUTHORS: Kuz'minskiy, A.S., Professor, Zhuravskaya, Ye.V.

TITLE: The Resistance of Rubbers to the Action of Ionizing Radiation
(Stoykost' rezin k deystviyu ioniziruyushchikh izlucheniye)

PERIODICAL: Khimicheskaya nauka i promyshlennost', 1959, Vol 4, Nr 1,
pp 69-73 (USSR)

ABSTRACT: The development of the atomic industry needs radiation-resistant rubbers. This resistance is determined by the stability, relative lengthening, elasticity, hardness, etc measured after a fixed exposure time. Ionizing radiation produces large amounts of ions and excited molecules, destroys chemical bonds and forms free radicals. There are two principal processes: the destruction of macromolecular chains and the structure formation, consisting in the formation of chemical C-C bonds between separate polymer molecules. The increase of the density of the three-dimensional net is accompanied by a reduction of the relative lengthening and elasticity as well as by an increase of the hardness. At doses of $5 \cdot 10^8 - 10^9$ r most rubbers are transformed into a brittle glass-like material. The effect depends essentially on the nature of the rubber.

Card 1/3

SOV/63-4-1-10/31

The Resistance of Rubbers to the Action of Ionizing Radiation

The different rubber types may be arranged in the following declining series: polydimethyl-siloxane rubber (SKT), butadiene-nitrile (SKN-26), sodium-butadiene (SKB), vinyl-pyridine, butadiene-styrene (SKS-30), natural, and isoprene rubber. The equilibrium module is approximately proportional to the number of cross connections per 1 cm³ of polymer. Figure 1 shows the changes of this module at an irradiation of $26 \cdot 10^6$ r/hour. The low structure formation of natural rubber is explained by the simultaneous destruction. Butyl-rubber is the less resistant to ionization. Acrylates, chloroprene and nitrile polymers may be recommended at doses to 10^7 r. Vulcanizates on the base of butadiene-styrene copolymers retain satisfying physical-mechanical indices at doses of 10^9 r. Heat- and ionization-resistance was tested simultaneously in polysilicon, urethan-isocyanate and fluoro-elastomers. Urethan-isocyanates show good results at doses of up to $10^8 - 10^9$ r. Irradiation of sulfur vulcanizates by small doses leads to the formation of additional C-C cross bonds with increased heat-resistance. The radiation-resistance of synthetic rubbers is lower than that of natural rubber. Vulcanization conditions have no effect on radiation-resistance. The introduction of anti-

Card 2/3

SOV/63-8-1-10/51

The Resistance of Rubbers to the Action of Ionizing Radiation

oxidants has a positive effect in this respect. The presence of chemically bound sulfur reduces the rate of structure formation. The use of large amounts of "heavy" fillers, like lithopone, accelerates the aging process. The brittleness and hardness induced by irradiation cannot be eliminated by means of plasticizers, like dibutyl-sebacinate, dioctyl-phthalate, etc. Protective additions are aniline and benzoquinone in the case of polymethylmethacrylate as well as acceptors for free radicals, like m-dinitrobenzene, 2,4-dinitrophenol, etc. "Modified" fillers which adsorbed various ingredients on their surface and then subjected to irradiation show good results [Ref 17].

There are 2 sets of graphs, 1 table, and 30 references, 5 of which are Soviet, 24 English and 1 French.

Card 3/3

KUZ'MINSKIY, A.S., prof.; ZHURAVSKAYA, Ye.V.

Resistance of rubbers to ionizing radiation. Khim.nauka 1
prom. 4 no.1:69-73 '59. (MIRA 12:5)
(Rubber--Testing) (Radiation)

5(4)

AUTHORS:

Lezhnev, N.N., Nikitina, T.S., Kuz'minskiy, A.S.

SOV/63-4-3-23/31

TITLE:

On the Modification of the Surface of Carbon Blacks by the Action of Ionizing Radiation

PERIODICAL:

Khimicheskaya nauka i promyshlennost', 1959, Vol 4, Nr 3, pp 407-408 (USSR)

ABSTRACT:

The strengthening effect of carbon black is determined by the adsorption properties of its particles. The surface may be modified by radio-chemical addition of various compounds. The irradiation was carried out by a Co^{60} source of 22,000 g-equ. Phenyl- β -naphthylamine, mercaptobenzothiazol, sulfur and rubber of the type SKS-30A were physically adsorbed. The mechanical properties of the vulcanizates were studied on the Polani dynamometer. A considerable effect is obtained by irradiating carbon black with rubber chemically adsorbed on its surface. There are 2 tables.

Card 1/2

SOV/63-4-3-23/31
On the Modification of the Surface of Carbon Blacks by the Action of Ionizing Radiation
ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti (Scientific Research Institute of the Rubber Industry)

Card 2/2

21(4)

AUTHORS:

Galil-Ogly, F. A., Nikitina, T. S., Dyumayeva, T. N.,
Novikov, A. S., Kuz'minskiy, A. S.

SOV/89-6-5-6/33

TITLE:

On the Radiation Vulcanization of Fluorine Copolymers
(O radiatsionnoy vulkanizatsii ftorsopolimerov)

PERIODICAL:

Atomnaya energiya, 1959, Vol 6, Nr 5, pp 540-545 (USSR)

ABSTRACT:

If rubber-like fluorine copolymers are irradiated, rubber having unsatisfactory physical and mechanical properties is obtained. If various additions are added to these substances before irradiation, rubber having valuable technical properties may be obtained. The rubber-like fluorine copolymer "Kel'-F" is experimentally used as elastomer. Irradiation was carried out with Co^{60} -disks (thickness 0.3 to 1.0 mm) with an activity of 1400 and 21000 gramequivalent Ra. The integral absorbed energy corresponded to 3 to 80.10⁶ r. The structural change in the irradiated material was determined from the changed solubility, from the swelling limit in acetone, from the modulus E_{∞} , and from other physico-mechanical parameters. As additions the following substances are used: Channel black, white soot, furnace carbon black, thermal carbon

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SOV/89-6-5-6/33

On the Radiation Vulcanization of Fluorine Copolymers

black, and zinc oxide. The experimental results are tabulated and partly shown in form of graphs. The following is worth mentioning in connection with the curves: Dependence of tearing strength, the relative elongation, the modulus E_{∞} , and the swelling limit on the radiation dose; the influence exercised by air and vacuum on swelling and the modulus E_{∞} in the case of various radiation doses; the influence exercised by the addition of carbon black on spatial net formation as a result of irradiation. Dependence of the strength of the rubber on the quantity of carbon black added (irradiation dose $20 \cdot 10^6$ r). The following general conclusions may be drawn from the experiments: The surface activity of the additional substances exercises a decisive influence on the properties of the rubbers. The rubber which contains channel black as an addition possesses the best technical properties after irradiation. It is, above all, more resistant to heat-aging, solubility, and static deformation. The fluorine copolymers of the "Kel'-F"-type tend more towards cross-linking than polytetrafluoroethylene and polytrifluoroethylene chloride. Cross-linking is promoted by the addition of oxygen. There are 9 figures, 1 table, and 10 references, 2 of which are Soviet.

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SOV/89-6-5-6/33

On the Radiation Vulcanization of Fluorine Copolymers

SUBMITTED: February 15, 1958

Card 3/3

15,9130

83295

S/138/59/000/010/007/010

A051/A029

AUTHORS: Kuz'minskiy, A.S.; Frenkel', R.Sh.; Khanin, S.Ye.; Fel'dshteyn, L.S.

TITLE: The Effect of Certain Organic Acid Salts on Rubber Vulcanization ¹⁵

PERIODICAL: Kauchuk i Rezina, 1959, No. 10, pp. 32 - 35

TEXT: The problem of increasing the rate of vulcanization of rubber without decreasing the initial plasticity of the mixtures and without causing any detriment to the scorching resistance and the physico-mechanical properties of the vulcanizates was studied. The use of inorganic bases as activators did not always render favorable results due to the poor distribution of the base in the mixture and the tendency of the mixtures to scorching. Organic substances with an alkaline nature, such as aliphatic amines, were also applied with the result that the vulcanizates had better physico-mechanical properties and a higher rate of vulcanization, but the mixtures containing triethanolamine acquired an elevated hardness, had a tendency to scorching and too wide a range of their physico-mechanical properties. The accelerating effect of potassium, sodium and ammonium salts of weak acids, such as orthophosphoric acid, acetic acid and benzoic acid

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S/138/59/000/010/007/010
A051/A029

The Effect of Certain Organic Acid Salts on Rubber Vulcanization

were investigated. In the case of the salts of ortho-phosphoric acid, there was some accelerating action, but the same shortcomings were observed as in the case of sodium hydroxide or sodium. The salts of acetic and benzoic acids proved to be very good activators of the organic accelerators.¹⁵ The strongest activator was shown to be ammonium benzoate, obtained from the reaction between an aqueous solution of ammonia and benzoic acid. The physical and chemical properties of this salt are listed and Tables 1 - 3 show the compositions and the physico-mechanical indices of the rubbers investigated. Figures 1 and 2 show the vulcanization level of the mixtures with ammonium benzoate. The latter actually serves as an activator of other organic accelerators, since it has only a slight accelerating action itself. The activating effect of this salt is present in mixtures not containing sulfur. The accelerating action of ammonium benzoate is explained by the alkaline properties of ammonia which forms during the vulcanization process. In addition to this, the benzoic acid which forms upon the decomposition of the ammonium benzoate also has been found to have some activating effect in the last stages of the vulcanization process. It increases the hardness of the vulcanizates and slows up the vulcanization at the processing temperature of the mixture.

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The Effect of Certain Organic Acid Salts on Rubber Vulcanization

The following conclusions are drawn: it is possible to accelerate the vulcanization of rubber using ammonium benzoate; by using this salt the range of activators can be increased and a saving on expensive organic accelerators is gained; the time needed to reach the optimum of the rubber mixture vulcanization can be decreased by 2 to 3 times; the scorching resistance and the physico-mechanical properties of the vulcanizates are not jeopardized from the use of the ammonium benzoate salt. There are 3 tables, 2 graphs and 11 references: 10 Soviet and 1 English. IX

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti (Scientific Research Institute of the Rubber Industry)

Card 3/3

S/138/59/000/011/003/011
A051/A029

AUTHORS: Kuz'minskiy, A. S.; Frenkel', R. Sh.

TITLE: On the Problems of Decreasing the Tendency of Rubber Mixtures
to Scorching

PERIODICAL: Kauchuk i Rezina, 1959, No. 11, pp. 14-16.

TEXT: The action mechanism of various salts of benzoic acid was studied in order to determine their value as anti-scorching agents, i.e., substances which would retard the vulcanization process at temperatures of 100-110°C. It was found that the most effective anti-scorching agent was cadmium benzoate. This was explained by the formation of the captax cadmium salt from the reaction between the cadmium benzoate and the mercaptobenzothiazole. It was also found that mixtures containing the cadmium salt of mercaptobenzothiazole have a considerable lesser tendency to scorching than similar mixtures containing cadmium benzoate and captax. The composition of the investigated mixtures is given in Table 1. The captax cadmium salt was tested in mixtures based on natural rubber in comparison with the combination of captax and cadmium benzoate (captax and its cadmium salt were used in equimolecular quantities). Table 2 shows that the addition of small

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S/138/59/000/011/003/011
A051/A029

On the Problems of Decreasing the Tendency of Rubber Mixtures to Scorching

quantities of benzoic acid to the mixtures containing cadmium captax salt hardly affects the rate of vulcanization. The reaction equation is given where it is seen that probably not the total amount of captax changes into cadmium salt, since the mixture containing the cadmium salt has a much lower tendency to scorching than a mixture containing the equivalent amount of captax and cadmium benzoate. Figure 1 shows that vulcanizates containing either captax or its cadmium salt have the same rate of vulcanization and have the same physico-mechanical properties and thermal-aging resistance. ✓
The mixtures which were compared contained combinations of captax or its cadmium salt with DFG or thiuram. The authors conclude that the application of cadmium salt of captax in industry helps to obtain a quickly-vulcanizing mixture without tendencies to scorching and that the cost of the mercapto-benzothiazole cadmium salt is less than the corresponding quantity of captax and cadmium benzoate. There are 2 tables, 4 graphs and 3 Soviet references. ✓

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti
(Scientific Research Institute of the Rubber Industry)

Card 2/2

ALL MINOSKIV, A.S.

Chemical conversions of polymers. A. S. Kuz'minskii (Research Inst. Plastic Ind., Moscow). *Acta Chim. Acad. Sci. Hung.* 18, Nos. 1-4, 333-9 (1959) (in Russian).—Kinetics of polymer oxidn. in the presence of an inhibitor were studied exptl. by following the rate of consumption of phenyl-2-naphthylamine. The inhibitor consumption was proportional to the induction period; it was independent of concn. in rubber, but was increased by temp. increases

2 g. (m₁)

4E2C (j)

or mech. strain. The complete inhibitor consumption marked the beginning of O absorption. Introduction of the inhibitor into the rubber polymer during the period of autocatalysis interrupted the reaction, and a new induction period was initiated, while removal of the inhibitor from rubber caused an autocatalytic oxidn. The consumed inhibitor was chem. bound to the rubber, but the inhibitor did not interact with the CH-radicals of rubber. The rate of inhibitor consumption was approximately equal to the rate of initiation of the oxidn. process. The energy of activation, calcd. from initiation consts. and their dependence on temp., was 22.5 kcal./mole. It was also established that during the oxidn. in the presence of the inhibitor mech. properties of rubber changed slowly, but when the inhibitor had been consumed a rapid deterioration took place. Reactivity of polymers depends entirely on the concn. of double bonds in the main chain of the mol. Kinetic consts. detd. at the initial stage of the oxidn. govern the course of the reaction, depending on the structure of rubber and on exptl. conditions.

Ray V. Mihalovich

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7(3), 24(7)

SOV/48-23-10-16/39

AUTHORS: Postovskaya, A. F., Kuz'minskiy, A. S.

TITLE: Investigation of the Structural Variations of Vulcanizates Under the Effect of Mineral Acids

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 10, pp 1213-1216 (USSR)

ABSTRACT: As in practice rubber parts frequently come into contact with mineral acids, an investigation of the influence exercised upon structure was of interest. The authors investigated the structural changes caused by nitric- and hydrochloric acid in thermo-vulcanizates of sodium butadiene rubbers (SKB) and in the thermo-vulcanizates of divinyl styrene rubber (SKS-30). The investigation was carried out by means of infrared spectroscopy within the range of $3800-600\text{ cm}^{-1}$ by using a spectrometer of the type IKS-2. Action of the acids (25-50%) took place at 25 and 80° on vulcanizate films having a thickness of 30μ . The results are shown by figures 1 and 2. The following absorption bands were found in SKB rubber: 680, 720, 910, 965, 992, 1300, 1360, 1437, 1457, 1640, 1825, 1856, 2926, 2979, 3019 and 3080 cm^{-1} . As a result of thermal vulcanization the following

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Investigation of the Structural Variations of Vulcanizates Under the Effect of Mineral Acids

SOV/48-23-10-16/39

bands had been newly added: 1700-1710, 1240 and 3450 cm^{-1} . They corresponded to the groups

>C=O , $\text{-}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{-O-R}$, -OOH and OH . Treatment with nitric acid led to the occurrence of the bands 759, 854, 1360, 1550 and 1672 cm^{-1} . This treatment led to the formation of oxygen-containing and nitrogen-containing groups in the vulcanizate. A spectroscopic analysis of the SKS-30-film treated with 25% hydrochloric acid at 25° resulted in no structural changes and no addition of chlorine, even in the case of acid being active for 6 days. This agrees with data obtained by another method. Only after an action lasting 14 days a chlorination effect (occurrence of bands at 600, 650, 700-750 cm^{-1}) was found. At higher temperatures the chlorination process developed more rapidly. The authors finally thank V. M. Tatevskiy and M. A. Salimov for promoting this work and for their participation in it. There are 2 figures and 11 references, 1 of which is Soviet. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti (Scientific Research Institute of Rubber Industry), Komiteta Soveta Ministrov SSSR po khimii (of the Committee of the USSR

ASSOCIATION:

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Investigation of the Structural Variations of Vulcanizates Under the Effect
of Mineral Acids

SOV/48-23-10-16/39

Council of Ministers for Chemistry)

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SOV/80-32-2-26/56

AUTHORS: Degteva, T.G., Belitskaya, R.M., Kuz'minskiy, A.S.

TITLE: The Effect of Phenyl- β -Naphthylamine and Sulfur on the Oxidation of Hydrocarbons (Vliyaniye fenil- β -naftilamina i sery na okisleniye uglevodorodov)

PERIODICAL: Zhurnal prikladnoy khimii, 1959, Vol XXXII, Nr 2, pp 382-386 (USSR)

ABSTRACT: The effect of phenyl- β -naphthylamine and sulfur on the oxidation of low-molecular hydrocarbons has been investigated in order to understand the oxidation process of swelling vulcanized rubbers. For the experiments the hydrocarbons tetralin and decalin were used. Phenyl- β -naphthylamine shows only a slight effect on the oxidation of tetralin and appreciably retards the oxidation of decalin (Figures 2 and 3). During oxidation amine is consumed, in the case of decalin almost completely after 6 hours (Figure 6). After complete consumption an accumulation of peroxide compounds is observed. Phenyl- β -naphthylamine has no effect on the thermal decomposition of the hydroperoxides of tetralin and decalin. The introduction of sulfur together with phenyl- β -naphthylamine

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SOV/8C-32-2-26/56

The Effect of Phenyl- β -Naphthylamine and Sulfur on the Oxidation of Hydrocarbons

increases the thermal decomposition of decalin peroxides. At 150°C the decomposition is complete. This increase is due to the interaction of sulfur with the radicals RO and OH which causes a chain process of decomposition. There are 8 graphs, 1 diagram, 1 table, and 11 Soviet references.

SUBMITTED: September 13, 1957

Card 2/2

AUTHORS: Angert, L.G., Gol'dfarb, Ya.L., Goroshina, O.L., Zenchenko, A.L., Kuz'minskiy, A.S., Fedoryn, N.P. SOV/OC-32-2-32/56

TITLE: Syntheses of Some Thiophene Derivatives and the Study of Their Behavior as Ingredients of Resins (accelerators and Antioxidants) ((Sintezy nekotorykh protivodaykh tiofena i issledeniye ikh povedeniya v kachestve ingrediyyentov smol (uskoriteley i antioksidantov))

PERIODICAL: Zhurnal prikladnoy khimii, 1959, Vol XLIII, No 2, pp 406-416 (USSR)

ABSTRACT: A total of 13 compounds of the thiophene series were investigated as ingredients of resin mixtures. They all contained the α -methine group XC_4H_3SCH - SHY, where X is hydrogen or CH_3 , Y is an aliphatic or aromatic radical, and S is a substituting group. Secondary amines were prepared by heating thienyl di-chlorides with amines in a solution of benzene or toluene. The products of this reaction, their melting and boiling points, analyses and yields are given in Table 2. These compounds inhibit the oxidation of rubber. The inhibiting action is due to the nature of the ortho- and para-groups in the benzene ring. As a control sample rubber containing phenyl- β -naphthylamine was used in the experiments. The thienyl group $C_4H_3SCH_2$ has nearly the same inhibiting influence

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as the phenyl group. The most pronounced effect have the inhibitors 3-methyl-2-thienylidene- α -aminophenol, 2-thienyl- β -naphthylamine, etc. The synthesized compounds were tested also as vulcanization accelerators on the rubbers SKB, SKB-90, SKB-26 and SK. Most effective were 2-mercapto-4-(2'-thienyl)-thiazole and 41-2-thienylideneethylenediamine. The thienylidene group had a greater effect on vulcanization acceleration than the benzene ring. There are 3 tables, 1 graph and 20 references, 10 of which are Soviet, 3 American, 3 English, 2 German, and 2 French.

SUBMITTED: May 13, 1957

Card 2/2

5(4)

SOV/76-33-2-33/45

AUTHORS:

Postovskaya, A. F., Kuz'minskiy, A. S.

TITLE:

Studies on the Structural Changes of Vulcanised Rubber Caused by the Action of Nitric Acid (Issledovaniye strukturnykh izmeneniy vulkanizatorov **kauchuka** pod deystviyem azotnoy kisloty)

PERIODICAL:

Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 2, pp 447 - 451 (USSR)

ABSTRACT:

Despite the fact that many rubber products are exposed to the action of nitric acid (I) no systematic investigations have been carried out in regard to this action. In the present paper structural differences were studied in the following vulcanisates: I) a thermovulcanisate of sodium butadiene rubber (produced from SKB rubber); II) a sulfur-containing sodium butadiene vulcanisate (from SKB); and III) a thermovulcanisate of a divinyl styrene rubber (from SKS-30). The investigations were carried out using an infra-red spectroscope. The spectra were recorded using an IKS-2 spectrograph at $3800-650\text{ cm}^{-1}$ in the MGU in the laboratoriya molekulyarnoy spektroskopii prof. V. M. Tatev-

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Studies on the Structural Changes of Vulcanised Rubber
Caused by the Action of Nitric Acid

SOV/76-33-2-33/45

skiy (Laboratory for Molecular Spectroscopy of Professor V. M. Tatevskiy), and were made by M. A. Salimov. Vulcanisate films 30 μ thick were exposed to the action of 10-50% nitric acid at 25 and 80°. The adsorption spectra obtained show (Figs 1-3) that in the action of the nitric acid upon the SKB thermovulcanisate two processes occur: an oxidation in which oxygen-containing compounds are formed (peroxide, hydroxyl, carbonyl groups, etc) and a nitration yielding nitro compounds. The nature of the reaction products depends to a large extent upon the concentration and upon the temperature. Both processes are markedly accelerated by an increase in temperature. It was found that in a nitration a "structuration" preponderantly takes place (Table), while in oxidation a destruction occurs. Professor V. M. Tatevskiy and M. A. Salimov are thanked in closing. There are 3 figures and 8 references, 2 of which are Soviet. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti MKhP (Scientific Research Institute of the Rubber Industry of the MKhP)
July 23, 1957

ASSOCIATION:

SUBMITTED:
Card 2/2

5(4)

AUTHORS:

Kuz'minskiy, A. S., Zaytseva, V. D., Lezhnev, N. N.

SCV/20-125-5-29/61

TITLE:

On the Suppression of the Catalytic Effect of Polyvalent Metals in Rubbers (O podavlenii kataliticheskogo deystviya polivalentnykh metallov v kauchukakh)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 5, pp 1057 - 1060 (USSR)

ABSTRACT:

The suppression of the catalytic effect of polyvalent metal ions contained in rubbers is an important, though hitherto little investigated problem. This gap is partly filled by the present paper. The behavior of metal salts was investigated in divinyl-styrene rubber as well as in natural rubber. The authors determine the rate at which oxygen is absorbed by rubber at various temperatures and the variation of rubber structure from the viscosity of its solution in benzene. The results obtained by these investigations are shown by 3 diagrams. It was found useful to investigate the binding of metal ions to stable, catalytically inactive complexes. These complexes (which are apparently formed by an electron of the

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On the Suppression of the Catalytic Effect of
Polyvalent Metals in Rubbers

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d-layer of the Cu^{++} -ion or by 5 electrons of Fe^{+++} and Mn^{++} not joined in pairs) show a complete blocking of the central ion by the molecules of the addend, so that transition of the electrons from this ion to the substratum (peroxide of rubber) or vice versa becomes impossible. The first part of the present paper deals with the ability of metal salts to form complex compounds with the various ingredients of rubber mixtures, viz. in low-molecular compounds and in the rubber substance. The binding of the copper ion by the antioxidant in the benzene solution was investigated by observing the fluorescence of the solution of these substances in benzene and alcohol. The conditions warranting the complete extinction of fluorescence are given by a table. As the extinction of fluorescence may be brought into connection with the blocking of the ion, it indicates a decrease of the possibility of a valence transition and consequently a decrease of the catalytic activity of the metal ion. The authors then investigated the possibility of the formation of the aforementioned complex compounds in the rubber substances. The

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Polyvalent Metals in Rubbers

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compounds of iron and rubber with certain components of rubber form stable complex compounds, which may be obtained by the precipitation of acid or basic aqueous solutions from them. The components which had not participated in the reaction must then be carefully washed out. The composition of these compounds is shown by a table. The relations of the molecules of organic compounds to the metal atoms, as shown in these tables, can in most cases not be represented in form of a definite structure, and therefore this problem is in need of further investigation. The reaction between the complex-former and the metal in the rubber medium develops completely but slowly. 3 diagrams contain data concerning the kinetic oxidation of rubber in the presence of complex compounds (formed immediately in the carboniferous medium of the rubber), and also concerning the synthesized complex compounds introduced into a rubber. The bound metal ions exercise no influence whatever upon the rate of oxidation or upon the structural variation of rubber, i.e. they lose their catalytic activity. Therefore, rubbers able to form

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On the Suppression of the Catalytic Effect of
Polyvalent Metals in Rubbers

SOV/20-125-5-29/61

complex salts with the ions Cu^{++} , Fe^{+++} , etc have a greater stability with respect to the salts of polyvalent metals than the rubbers used for their production. There are 3 figures, 2 tables, and 6 references, 1 of which is Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy institut rezinovykh i lateksnykh izdeliy (Scientific Research Institute for Rubber- and Latex-Products)

PRESENTED: January 3, 1959, by P. A. Rebinder, Academician

SUBMITTED: December 22, 1958

Card 4/4

PHASE I BOOK EXPLOITATION

SOV/984

International symposium on macromolecular chemistry. Moscow, 1960.

Nashumardoviy simpozium po makromolekulyarnoy khimii SSSR, Moskva, 14-18 iyunya 1960 g.; doklady i referaty. Sektsiya III. (International Symposium on Macromolecular Chemistry Held in Moscow, June 14-18, 1960; Papers and Summaries) Section III. [Moscow, Izd-vo AN SSSR, 1960] 469 p. 55,000 copies printed.

Tech. Ed.: P. S. Kashina.

Sponsoring Agency: The International Union of Pure and Applied Chemistry. Commission on Macromolecular Chemistry.

PURPOSE: This book is intended for chemists interested in polymerization reactions and the synthesis of high molecular compounds.

COVERAGE: This is Section III of a multivolume work containing papers on macromolecular chemistry. The articles in general deal with the kinetics of polymerization reactions, the synthesis of special-purpose polymers, e.g., ion exchange resins, semiconductor materials, etc., methods of altering polymerization reactions, properties and chemical interactions of high molecular materials, and the effects of various factors on polymerization and the degradation of high molecular compounds. No new specialties are mentioned. References given follow the article.

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26883
S/081/61/000/013/023/028
B117/B203

15.9380

AUTHORS: Degteva, T. G., Kuz'minskiy, A. S.

TITLE: Aging of rubbers in oils

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 13, 1961, 653, abstract
131332 (Tr. N.-i. in-ta rezin. prom-sti, sb. 6, 1960, 54-68)

TEXT: The authors studied the effect of oil based on the petroleum-gasoline fraction upon the aging of filled CKH-18 (SKN-18) rubber at different temperatures. The possibility of applying the quantitative extrapolation method of aging rates from high temperatures down to 25°C permitted a calculation of the service life of rubbers in oil. It was 20 years for relaxed rubbers (as to their relative elongation). It was 9-10 years for stretched rubbers (as to the accumulation of residual strain and stress relaxation). The service life was calculated in consideration of the correction factor of 0.5-0.6. The cause of aging of rubber in oil are thermal oxidation processes; rubber and low-molecular hydrocarbons may undergo coupled oxidation. The apparent activation energy (E) of the aging process is 18.3 kcal/mole for rubber in free state in air and in oil

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